Case Report

Temporal intrailiac balloon occlusion for the treatment of intractable pelvic fracture hemorrhage

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Case: A 48-year-old schizophrenic man sustained multiple injuries following a fall. Unstable pelvic fractures were diagnosed in the emergency department. The patient's hemodynamic status was stabilized following bilateral internal iliac artery embolization using a gelatin sponge. However, recurrent bleeding and an expanding retroperitoneal hemorrhage occurred 1 h after transcatheter arterial embolization.

Outcome: Using temporal intrailiac balloon occlusion, with preperitoneal gauze packing, the patient's hemodynamic status was stabilized in the intensive care unit. No complications were observed following transcatheter arterial embolization and balloon occlusion.

Conclusions: Temporary intrailiac balloon occlusion is a rapid and safe treatment for refractory pelvic hemorrhage, which can be administered simultaneously with other treatments including preperitoneal gauze packing and external fixation.

Key words: Balloon occlusion, internal iliac artery, pelvic fracture, preperitoneal gauze packing, transcatheter arterial embolization

INTRODUCTION

THE MANAGEMENT OF hemodynamically unstable pelvic fracture patients presents a challenge to trauma centers. The treatment options for pelvic fracture hemorrhage include transcatheter arterial embolization (TAE), external fixation, and preperitoneal gauze packing. However, conjecture remains regarding the optimal treatment method.[1–3] Transcatheter arterial embolization is a rapid and established technique for controlling intractable hemorrhage during pelvic fractures.[1] A previous report showed that resuscitative endovascular balloon occlusion of the aorta was useful during the trauma resuscitation for patients severely injured after abdominal or pelvic trauma, which temporarily regulated intra-abdominal hemorrhage.[4,5] Temporal intrailiac balloon occlusion can also be used to control hemorrhage following pelvic trauma.[6] We herein describe our experience of using temporal intrailiac balloon occlusion for the treatment of intractable recurrent pelvic hemorrhage.

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CASE

A 48-YEAR-OLD SCHIZOPHRENIC MAN sustained multiple injuries following a fall. Closed left femoral, tibial, bilateral ankle, and pelvic fractures were diagnosed in the emergency department. On admission, the patient's blood pressure (BP) was 154/136 mmHg, his heart rate (HR) was 118 b.p.m., and consciousness, measured by the Glasgow Coma Scale, was at E3V5M6. Although the hemodynamic status of the patient suddenly worsened (systolic blood pressure [SBP], 70 mmHg; HR, 160 b.p.m.) during primary trauma resuscitation, he showed transient response to rapid 2-L infusion of extracellular fluid. Initial contrast-enhanced computed tomography (CT) revealed a left sacral bone fracture and retroperitoneal hematoma without contrast extravasation (Fig. 1A,B). The pelvic hemorrhage was considered as the bleeding source contributing the patient's hemodynamic instability and emergency hemostasis was required.

After stabilizing the pelvis (by wrapping it with a sheet), the patient was transported to an angiography suite.

The right common femoral artery approach was chosen. There was no initial extravasation of contrast medium from the bilateral internal iliac artery. However, initial angiogram showed vasospasm of the left internal iliac artery, which was considered an indirect sign of vascular injury (Fig. 1C). Considering the patient's hemodynamic instability, prompt

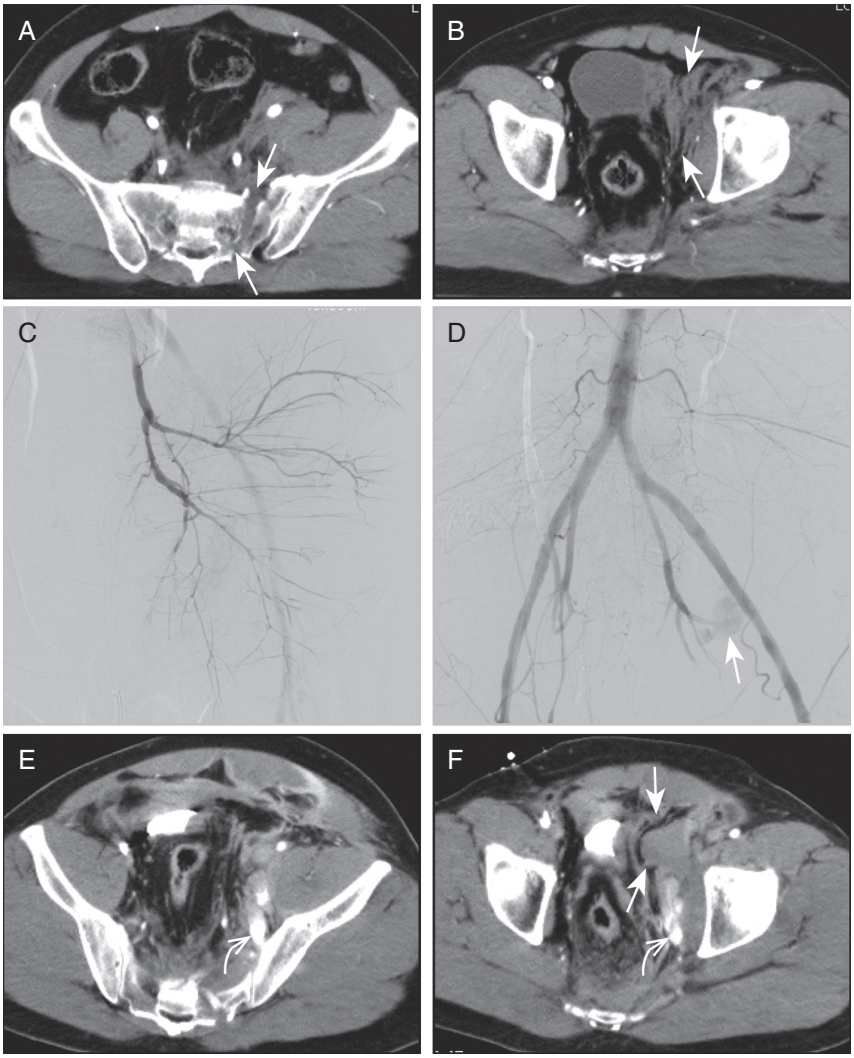

Fig. 1. On admission of a 48-year-old man who sustained multiple injuries following a fall, contrast-enhanced computed tomography showed a left sacral bone fracture (A, arrow) and retroperitoneal hematoma (B, arrow) without contrast extravasation. Initial angiogram showed vasospasm of the left internal iliac artery without contrast extravasation, which was considered an indirect sign of vascular injury (C). Aortography following bilateral internal iliac artery embolization revealed a pseudoaneurysm in the proximal portion of the superior gluteal artery (D, arrow). Contrast-enhanced computed tomography images were taken 1 h after transcatheter arterial embolization. Recurrent filling in the pseudoaneurysm (E, F, curved arrow), arterial hemorrhage, and expanding retroperitoneal hematoma (F, arrow) were observed.

embolization was required for hemostasis. Aortography following bilateral internal iliac artery embolization, with an absorbable gelatin sponge, revealed a pseudoaneurysm in the proximal portion of the superior gluteal artery (Fig. 1D). Considering the operator's skill and difficult access for the recurrent embolization, we could not embolize the superior gluteal artery using a microcoil. Continuous hemodynamic instability (BP, 123/67 mmHg; HR, 169 b.p.m.) occurred despite bilateral internal iliac artery embolization, therefore recurrent embolization of the left internal iliac artery was carried out using a gelatin sponge; repeat contrast injection following embolization revealed no further filling of the pseudoaneurysm. Although the patient's vital signs were stabilized following this procedure, 5.2 French catheters, with 9-mm occlusive balloons (Selecon MP; Clinical Supply, Gifu, Japan), were positioned with the tip situated in the proximal portion of the left internal iliac artery, immediately subsequent to the common iliac artery bifurcation. This step was taken to prepare for recurrent bleeding.

The hemodynamic status of the patient gradually destabilized, with severe coagulopathy observed 1 h after TAE. Contrast-enhanced CT showed recurrent filling in the pseudoaneurysm, arterial hemorrhage, and expanding retroperitoneal hematoma (Fig. 1E,F). The patient was taken to the intensive care unit (ICU) for further resuscitation. His SBP was 84 mmHg despite continuous extracellular fluid administration and transfusion. Repeat TAE or preperitoneal gauze packing was considered. The balloon catheter was then inflated in the proximal portion of the left internal iliac artery (Fig. 2). Although a transient increase in SBP (104 mmHg) was observed immediately following intrailiac balloon occlusion, the patient's SBP dropped to 55 mmHg.

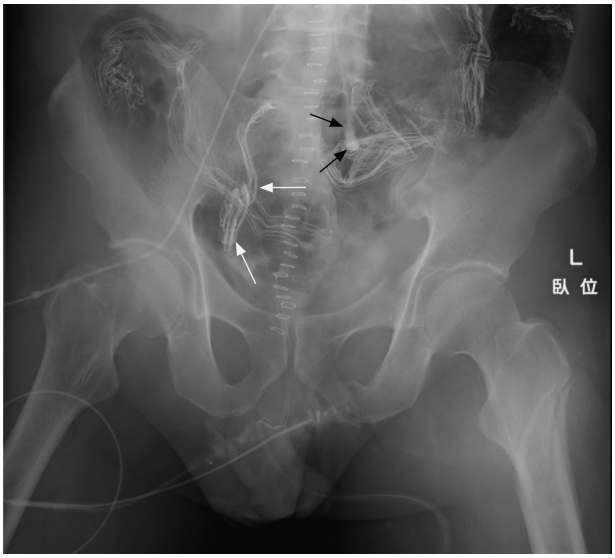

Fig. 2. Intrailiac balloon occlusion (black arrows) with preperitoneal gauze packing (white arrows) used to treat a 48-year-old man who sustained multiple injuries following a fall.

Preperitoneal gauze packing was carried out in the ICU (Fig. 2). Hemodynamic stability was consequently achieved postoperatively. The patient had concurrently transfused a total of 12 units of packed red blood cells and 18 units of fresh frozen plasma. The balloon was kept inflated for 12 h; vital signs were stable following balloon deflation. The stuffing was removed during secondary surgery, 48 h after pelvic packing. On postoperative day 4, contrast-enhanced CT revealed no further filling of the pseudoaneurysm. However, low-density areas of the swollen left gluteal muscle were observed, indicating direct injury or muscle ischemia. Consequently, the balloon catheter was removed.

The patient required internal fixation of the left femoral, tibial, bilateral ankle, and sacral bone fractures. On day 30 post-admission, contrast-enhanced CT revealed bilateral internal iliac artery revascularization. The left gluteal muscle showed good healing. Severe complications, such as gluteal muscle necrosis, skin necrosis, and paresis, were not observed. The length of the ICU stay was 39 days. The patient was transferred to a rehabilitation hospital following ICU discharge.

DISCUSSION

THE MANAGEMENT OF hemodynamically unstable pelvic fracture patients can be problematic for trauma centers. Bleeding typically originates from the pelvic arteries, or from fracture surfaces or adjacent venous structures. The treatment options for pelvic fracture hemorrhage include TAE, external fixation, and preperitoneal pelvic packing. Current treatment strategies use these options in combination; however, the optimal treatment approach remains a subject of debate.[1–3] Transcatheter arterial embolization is a rapid and established technique for controlling intractable hemorrhage in pelvic fractures.[1] In our patient, the hemodynamic instability suggested ongoing bleeding, although initial contrast-enhanced CT revealed retroperitoneal hematoma without contrast extravasation. A previous report showed that the presence of a pelvic contrast extravasation on CT scan is widely used as an indicator for significant arterial bleeding that may require pelvic hemorrhage control. However, the need for pelvic hemorrhage control in pelvic ring fracture patients should be determined more by the presence of clinical signs of ongoing bleeding, such as hypovolemic shock, than by the mere presence of a pelvic contrast extravasation on CT scan.[7]

Although highly effective for pelvic hemorrhage management, a subset of patients will require repeat TAE. An initial hemoglobin level of <7.5 g/dL, and super-selective arterial embolization during initial TAE, are independent predictors of repeat TAE.[8] In our patient, recurrent arterial hemorrhage may have occurred for several reasons, including inadequate embolization using absorbable materials, and transient vasospasm of the initial angiography. Restoration of hemodynamic status can result in vessel diameter increases and blood pressure improvements. Consequently, using an absorbable gelatin sponge as an embolic agent can dislodge blockages from embolized vessels. The recurrent arterial hemorrhage could have been avoided if we embolized the pseudoaneurysm with permanent occlusive agents such as microcoils or N-butyl cyanoacrylate. However, considering the operator's skill level and difficult access for recurrent embolization, we could not embolize the superior gluteal artery using a microcoil. Transcatheter arterial embolization is a rapid and effective resuscitation treatment for intractable pelvic arterial hemorrhage. However, combination strategies, including repeat TAE, preperitoneal gauze packing, and external fixation, should be considered in cases of recurrent hemodynamic instability following initial TAE.

Selective and non-selective TAE of the internal iliac artery and its branches is applied for pelvic arterial hemorrhage. Several materials, including absorbable gelatin sponges, microcoils, and N-butyl cyanoacrylate, are typically selected.[9,10] Temporal occlusion of the common iliac or internal iliac artery represents an alternative technique for controlling pelvic hemorrhage occurring during obstetric and pelvic surgery.[11,12] Furthermore, temporal intrailiac balloon occlusion can also control hemorrhages occurring after pelvic trauma.[6] We successfully stabilized the patient's

hemodynamic status using temporal intrailiac balloon occlusion with preperitoneal gauze packing in the ICU. The temporal balloon occlusion conferred three benefits. First, it allowed for the control of recurrent arterial hemorrhage under conditions of severe coagulopathy, although its effect seems to have been temporary because venous oozing and bleeding from sacral bone was considered as an additional bleeding source. Second, it was a rapid and safe treatment allowing for simultaneous application of preperitoneal gauze packing. Finally, it can decrease persistent venous oozing indirectly. Several clinical reports showed that resuscitative endovascular balloon occlusion of the aorta was useful in the resuscitation of severely injured patients after abdominal or pelvic trauma, which temporarily controlled intra-abdominal or pelvic hemorrhage.[4,5] It must be noted that potential complications of lower limb ischemia and vascular injury exist, and there is a high risk of multiple-organ failure after deflation of the aortic occlusion. Similarly, it must be noted that there are potential complications of lower limb ischemia and vascular injury if the balloon catheter is malpositioned when using temporary intrailiac balloon occlusion. Although all endovascular treatments confer a risk of endothelial damage, which can result in thrombus formation, complications following balloon occlusion were not observed in our patient. Temporary intrailiac balloon occlusion is a rapid and safe treatment for refractory pelvic arterial hemorrhage, allowing for simultaneous application of other treatments including preperitoneal gauze packing and external fixation.

CONCLUSION

WE HEREIN REPORT our experience using temporal intrailiac balloon occlusion, with preperitoneal gauze packing, to treat intractable recurrent pelvic hemorrhage. Temporary intrailiac balloon occlusion is a rapid and safe treatment for refractory pelvic arterial hemorrhage, allowing for simultaneous application of other treatments including preperitoneal gauze packing and external fixation.

CONFLICT OF INTEREST

NONE.

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